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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/681,922 | 10/09/2003 | Hwa-Young Kang | 5000-1-332 DIV | 7727 |

33942 7590 02/05/2004

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| EXAMINER |
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MULPURI, SAVITRI

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| ART UNIT | PAPER NUMBER |
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2812

DATE MAILED: 02/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|------------------------|---------------------|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/681,922 | KANG ET AL. | |
| | Examiner | Art Unit | |
| | Savitri Mulpuri | 2812 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 7-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 7-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. 10/346,315.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 7-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over
Admitted prior art in combination with Park et al (US 5,877,040) and Tanaka
(JP361280686A)

Admitted prior art teaches a method and product of photodiode by successively forming buffer layer "2"; light absorbing layer "3"; epitaxial layer "4" by metal organic chemical vapor deposition on a substrate "1"; forming patterned silicon nitride layer on epitaxial layer to expose part of the epitaxial layer; performing diffusion process using patterned silicon nitride as mask to form diffusion region on the active region "9"; forming top metal electrode on surface of the nitride and on the surface of the active region and bottom metal electrode on the bottom surface of the substrate. Admitted prior art inherently teach InP epitaxial layer and Zn diffusion. Admitted prior art does not teach selectively etching the epitaxial layer of the active region to form convex-lens shape region.

Park et al teaches forming active region of the photodiode in a convex-lens shape "34" by etching; forming doped region "36" on the top of the convex shape

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region. Park et al specifically teach the convex shape portion is part of the photodiode and not external to the photodiode. Park teaches patterned photosensitive mask "52" for forming convex shape photodiode, wherein mask "52" is lens and it photosensitive. Park teaches forming convex shape diode region contributes to enhanced photosensitivity (see 3A-3J and related description, col. 1, lines 60-65). It would have been obvious to one of ordinary skill in the art to use convex shaped photodiode for enhanced photosensitivity.

Park does not teach forming convex shape by selectively etching the active region "34" by using methanol bromide as an etchant.

Tanaka teaches forming convex shape from InP based layer by using methanol bromide as an etchant. It would have been obvious to one of ordinary skill in the art to use methanol bromide in the invention of Admitted prior art to etch the epitaxial layer active region to form convex shape photodiode by using methanol bromide as suggested by Tanaka.


Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Prior art generally teach forming photodiode.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Savitri Mulpuri whose telephone number is 703-272-1677. The examiner can normally be reached on Mon-Fri from 8 to 4.30 a.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on 703-272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Savitri Mulpuri
Primary Examiner
Art Unit 2812